

# THE AMERICAN SPECIES OF SPHYRADIUM WITH AN INQUIRY AS TO THEIR GENERIC RELATIONSHIPS.

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Land snails belonging to the genus *Sphyradium* are found in those parts of Europe, Asia, and North America generally designated as Holarctic. One species extends into the Neotropical realm, and two forms which, by the shell, apparently belong to the genus, are found in the Hawaiian Islands.

As the shell is distinctly Pupillid in character the group was originally included in the family Pupillidæ (or Pupidæ), but when the jaw and radula became such factors in the classification of the land snails, the genus was removed from this family and of late years it has been placed along with *Punctum* in a subfamily of the Endodontidæ, one of the divisions of the *Aulacopoda*.

Some live animals of *Sphyradium edentulum* (*Vertigo simplex* Gould, of Binney and others), were recently received from Caribou, Maine, collected by Mr. O. O. Nylander. A study of this material in considerable detail has revealed the fact that the form, by lacking pedal grooves, does not belong to the *Aulacopoda* and all the other anatomical characters other than those of the jaw and radula show that it is closely allied to the genus *Vertigo* of the family Pupillidæ.

The genus was removed from the Pupillidæ by Sterki<sup>1</sup> upon the structure of the radula. The jaw is by Sterki stated to be composed of numerous separate plates loosely joined together in a arcuated series. This is the condition of the jaw in *Punctum* and for this reason the two genera have been placed together in the Endodontidæ. According to Lehman,<sup>2</sup> however, the jaw is constructed of a single piece and the radula is but slightly different from what is found in *Vertigo*, 12—1—12, teeth in a transverse row. Different investigators seem to have obtained different results in their work on these

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<sup>1</sup> Sterki, *Nautilus*, vol. 10, 1896, p. 75.

<sup>2</sup> Lehman, *Lebenden Schnecken und Muscheln der umgegend Stettins und in Pommern*, 1873, p. 142, pl. 14, fig. 49.

organs.<sup>1</sup> When the rest of the anatomy is considered, however, it is seen that the genus can not belong to other than the Pupillidæ and in this family it is closely related to *Vertigo*.

### Genus SPHYRADIUM Charpentier.

Shell brown, translucent, cylindrical or subconical. Spire elevated and apex obtusely pointed. Axis minutely perforate. Aperture basal, semi-circular and without teeth. Peristome thin and acute, its plane radial from the axis, not reflected or thickened within with callus. No indentation in the upper palatal wall.

Animal without a lower pair of tentacles and foot without pedal grooves.

Kidney lying parallel to the rectum and with the urethra leading direct from the anterior end to the mantle margin. The granular matter of the kidney is not arranged in a series of longitudinal filaments as in most of the other Pupillidæ.

Penis with the vas deferens attached at the apex; flagella absent. Hermaphroditic gland composed of a single mass of granules. No demarcation between the oviduct and vagina.

The genus is closely related to *Vertigo*, from which it differs in having no teeth in the aperture of the shell, and the peristome thin and without a callus deposit. Also the surface of the foot is covered with a network of incised lines which are not found in any of the species of *Vertigo* examined by the writer. It is allied to this genus by the animal lacking a lower pair of tentacles and by the vas deferens being attached to the apex of the penis, not down on its side as in *Bifidaria* or *Pupoides*.

In America there are three species of *Sphyradium*. One of these has thus far been found only as a fossil and another is almost extinct.

#### Key to the American species.

- a. Shell more than 5 mm. in height.....*hasta*.
- a<sup>1</sup>. Shell less than 3.50 mm. in height.
  - b. Shell long and slender; whorls seven to eight.....*alticolum*.
  - b<sup>1</sup>. Shell shorter and more conical; whorls five to six.....*edentulum*.

#### SPHYRADIUM HASTA, new species.

Shell more than 5 mm. in height, long and cylindrical. Light brown in color and glossy. Spire greatly elevated but obtusely pointed on the apex. Whorls  $8\frac{1}{2}$  to 9, rather flattened on the face and the last subangulated around the periphery. The last six

<sup>1</sup> NOTE BY WILLIAM H. DALL.—Mr. Olaf O. Nylander of Caribou, Maine, having kindly furnished some fresh material, with the help of Miss Mary Breen the jaw and radula of *S. edentulum* from that locality were isolated, and prove the correctness of Doctor Sterki's observations. The jaw is narrow antero-posteriorly, arcuate, and composed of about 16 rhomboidal overlapping plates. A high magnification is required to bring out these features. The cusps of the teeth on the mature part of the radula were blackish instead of horn color, which is very unusual in the Pulmonata.

whorls are of about equal diameter; the first three increase rapidly. Lines of growth faint and oblique; apex smooth and white. Aperture somewhat angulated at the base of the columella. Peristome thin and acute, forming a regular curve without an indentation in the upper palatal region such as is present in most of the *Vertigos*. The aperture is very slightly thickened with callus on the inside of the peristome in the basal region. Peristome not reflected and with no callus crest back of the aperture. Teeth and lamellæ entirely absent from the aperture. Umbilicus with a very small perforation.

Length, 5.81 mm.; diameter, 2.03 mm.

This species differs from all others of *Sphyradium* by its much greater size and the relatively smaller aperture.

*Type*.—Cat. No. 214302, U.S.N.M., from the Pleistocene of Long Island, Phillips County, Kansas. The specimens of this species were collected by Mr. Edward C. Johnston and the writer in the autumn of 1910. They occur in deposits of sandy, green marl of undoubted Pleistocene age. With them were large numbers of other Pupillidæ, as well as other land snails. The entire fauna of the beds is foreign to the region at the present time, but is allied to the present day Canadian fauna. From this it is supposed that the animals lived just before or during the Glacial epoch.

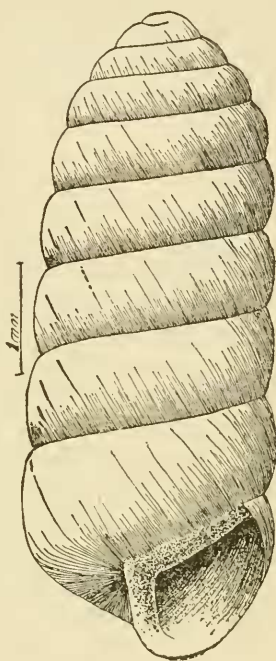


FIG. 1.—SPHYRADIUM HASTA HANNA, TYPE, CAT. NO. 214302, U.S.N.M. DRAWN BY G. D. HANNA.

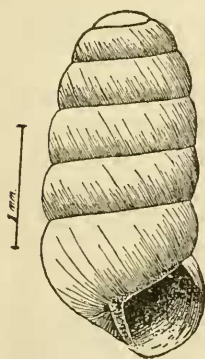


FIG. 2.—SPHYRADIUM ALTICOLUM INGERSOLL. DRAWN BY G. D. HANNA.

#### SPHYRADIUM ALTICOLUM Ingersoll.

*Pupilla alticola* INGERSOLL, U. S. Geol. Surv. of the Terr., Bull. 1, No. 2, ser. 2, p. 128 (1874); Eighth Ann. Rep. Hayden Surv., 1874, p. 391.

*Pupa alticola* (Ingersoll) BINNEY, Man. Amer. Land Shells, 1885, p. 174, fig. 166.

Shell between 2.50 mm. and 3.50 mm. in height, long and cylindrical. Light brown in color with the apex much lighter, sometimes white. Spire elevated and with the apex obtusely pointed. Whorls 7 to 8, well rounded on the face and with the sutures well impressed. The last whorl in adult shells is of greater diameter than the one preceding it, while the next three above it are of about equal size;

this expansion of the last whorl makes the shell slightly unsymmetrical. Peristome thin and acute, without callus, thickenings or indentations in the palatal wall. Lines of growth weak and oblique; apex smooth. Aperture larger in proportion to the shell than in either *S. hasta* or *S. edentulum*; entirely without teeth or lamellæ. The umbilicus is very slightly perforate.

Height.	Diameter.
3.33	1.74
2.81	1.11
2.70	1.14

This species is found at various places as a fossil in the Pleistocene and Loess deposits of the Mississippi Valley.<sup>1</sup> It is also found in several States of the Rocky Mountain region at the present time; i. e., in Utah, Colorado, and Wyoming.

Its abundance in the Pleistocene beds of Long Island, Phillips County, Kansas, shows that at one time this was a very common shell. Many specimens were found there in 1910 by Mr. Johnston and the writer. They were associated with *S. hasta* and other Pupilidæ which are at the present time apparently extinct.

This species can not be confused with any other United States land mollusk. The much greater height of the shell and the greater number of whorls shows it at once to be distinct from *S. edentulum*.

#### SPHYRADIUM EDENTULUM Draparnaud.

*Pupa edentula* DRAPARNAUD, Hist. Moll., 1805, p. 52, pl. 3, figs. 28, 29.

*Pupa simplex* GOULD, Bost. Journ. Nat. Hist., vol. 3, 1840, p. 403, pl. 3, fig. 21.

*Vertigo simplex* (Gould) BINNEY, Man. Amer. Land Shells, 1885, p. 191, fig 195.

Shell, smaller than either of the two preceding species, not more than 2 mm. in height; translucent brown in color, the apex not lighter than the body of the shell in live specimens. Outline conical rather than cylindrical; apex obtuse. Whorls four to five, well rounded on the face and with the sutures well impressed. Lines of growth very faint and oblique. Shell not spoiled in symmetry by the last whorl increasing in size unproportionately. Aperture well rounded and proportionately not so large as in *S. alticolum*; entirely without teeth or lamellæ. Peristome thin and acute, without callous thickenings or indentations. Umbilicus minutely perforate.

Height, 1.60 mm.; diameter, 0.80 mm.

The shell does not vary appreciably in size. It is a resident in that part of North America designated by the United States Biological Survey<sup>2</sup> as Transition and Canadian. It is also a resident of the northern parts of Europe and Asia.

<sup>1</sup> Pilsbry, Nautilus, vol. 11, 1898, p. 142.

<sup>2</sup> U. S. Biological Survey. Fourth Provisional Zone Map of North America, by C. Hart Merriam, Vernon Bailey, E. W. Nelson, and E. A. Preble, 1910.

Animal (fig. 3), with a rather short oval foot. Color dark about the head region, lighter posteriorly and on the sole of the foot. Lower tentacles absent. Foot without pedal grooves or traces of such structures. Surface of body covered with a network of incised lines, the meshes of which are very large. This network is absent in at least some of the *Vertigos*, but is present in all of the *Bifidaria* and *Pupoides* which the writer has had the opportunity to examine.

The breathing pore is situated at the upper right-hand angle of the mantle and with the anus immediately to the right. There are no black markings on the mantle or lung wall.

Kidney, a long, slender, granular walled pouch attached to the outer wall of the pallial cavity and with the posterior end lying against the anterior end of the albumen gland. The glandular matter of the kidney is not arranged in longitudinal filaments or folds as in most of the other Pupillids, but is evenly distributed over the entire inner surface. There is in the anterior end an indication of transverse bars which are more noticeable on the upper part of the urethra. The urethra leads directly from the anterior end of the kidney to the excretory pore, which is situated as in the other Pupillidæ. It opens into the anterior end of the pallial cavity, immediately posterior to the breathing pore. The size of the urethra and rectum is about the same and the two are separated by a considerable distance.

The salivary glands are united in one, but have a pair of ducts leading to the buccal mass, and passing beneath the cerebral nerve commissure and through the nerve collar.

The genitalia (fig. 4) are distinctly Pupillid in character. Hermaphroditic gland, composed of a single mass of grape-like granules as in *Vertigo*. In the Endodontidæ, where *Sphyradium* has heretofore been placed, this gland is composed of many individual bunches of elongated tubules, the bunches arranged in a diminishing series toward the apex. The gland of *S. edentulum* is embedded in the anterior end of the liver, which is light

brown in color. Hermaphroditic duct slightly swollen in its lower half, but not convoluted in any part. It discharges into the oviduct at the junction of the latter with the albumen gland.

The albumen gland is very large and massive, white and transparent, and on the posterior end there are a few scattering specks of black pigment. These are on the outer surface of the gland only. The oviduct is large at the posterior end and gradually diminishes in size



FIG. 3.—ANIMAL OF SPHYRADIUM EDENTULUM DRAPARNAUD WITH THE SHELL REMOVED, SHOWING THE KIDNEY. DRAWN BY G. D. HANNA.

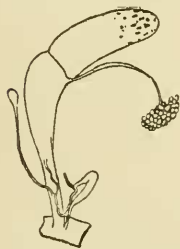


FIG. 4.—GENITALIA OF SPHYRADIUM EDENTULUM DRAPARNAUD. SPEC. NO. 142, OF THE WRITER'S COLLECTION OF ALCOHOLICS. MUCH MAGNIFIED. DRAWN BY G. D. HANNA.



anteriorly, passing imperceptibly into the vagina. It contains no folds or pouches, nor is there upon it such a shell gland (prostate) as is found in the Endodontidæ. The vagina is a wide tube, free of convolutions, and it opens to the exterior at the base of the right eye-stalk.

Spermatheca, small and globular with a slender duct almost as long as the oviduct and vagina. It discharges into the vagina near the lower end of the latter. There is no point of demarcation between vagina and oviduct, but for purposes of study and comparison in the Orthurethra it is convenient to call that part of the duct below where the vas deferens leads away, vagina, and that which is above, oviduct.

The penis is very small in comparison to the size of the other organs. This, however, is characteristic of the Pupillidæ. It is not attached to the vagina as usual in this family, and therefore there is no atrium; instead it opens to the exterior, on the vaginal lip. The penis is very slender at the point of exit, but enlarges gradually toward the upper end, where it is half the diameter of the vagina. The vas deferens leads from the center of the female organs, the junction of the vagina and oviduct, to the apex of the penis. The retractor muscle is attached to the vas deferens a little way down from the apex of the penis and also to the floor of the pallial cavity. Above the attachment of the vas deferens there is no continuation of the penis as in *Bifidaria* and no long flagella-like appendage as in *Pupoides*. In *S. edentulum* the condition is nearer what is found in some of the *Vertigos* as *V. ovata*.

The genitalia are most closely related to the *Vertigos* of any group of the Pupillidæ, thus bearing out the resemblance of the shells.

The jaw, radula, and genital organs of the European *S. edentulum* have been described and figured by R. Lehman.<sup>1</sup> His figures are not very good, but they show that the genitalia of the animal he had were very different from those of the form now under consideration. As he describes and figures these organs there is one long flagellum on the penis and two short thread-like ones. The larger one has a bulb-like enlargement on the outer end. He also says the oviduct is pouched and folded, and his figure shows a distinct demarcation between the oviduct and vagina. If the species he had was *S. edentulum* and if his dissections are correct, then the American form is specifically if not also generically distinct from the European, and the name, *S. simplex* Gould, will apply to our snail.

However, until modern methods of dissection are used on the European form, it is perhaps best to continue to refer the American snail to *S. edentulum*.

<sup>1</sup> Lehman, Lebenden Schnecken, etc., p. 142, pl. 14, fig. 49.